Essential Question: How can we write arithmetic and geometric sequences recursively?

Do Now:

Determine if the sequence below is arithmetic or geometric. For each sequence write an explicit rule that can be used to find the nth term of the sequence.

a) 4, 7, 10, 13, ...

$a_1 = 4$, $d = 3$ $\quad a_n = 4 + 3(n-1)$

b) 1, 3, 9, 27, ...

$a_1 = 1$, $r = 3$ $\quad a_n = 1(3)^{n-1}$

Arithmetic and Geometric Sequences can be defined <u>Recursively</u> and <u>Explicitly</u>

Let's take a closer look at the sequences from the Do Now.

Can the sequence 4, 7, 10, 13, ... be defined with a **recursive** rule?

$a_n = a_{n-1} + 3 \; ; \; a_1 = 4$

Can the sequence 1, 3, 9, 27, ... be defined with a **recursive** rule?

$a_n = a_{n-1} \cdot 3 \; ; \; a_1 = 1$

Writing Rules to Generate Arithmetic and Geometric Sequences

Arithmetic	Geometric
Explicit Rule: $a_n = a_1 + d(n-1)$ a_1 represents the **first term** in the sequence **d** represents the **common difference** This formula is used to find the nth term of the sequence.	**Explicit Rule:** $a_n = a_1 \cdot r^{n-1}$ a_1 represents the **first term** in the sequence **r** represents the **common ratio** This formula is used to find the nth term of the sequence.
Recursive Rule: $a_n = a_{n-1} + d \; ; \; a_1 =$ a_{n-1} represents the **previous term** in the sequence **d** represents the **common difference** This formula uses the previous term to find the next term in the sequence.	**Recursive Rule:** $a_n = a_{n-1} \cdot r \; ; \; a_1 =$ a_{n-1} represents the **previous term** in the sequence **r** represents the **common ratio** This formula uses the previous term to find the next term in the sequence.

use previous term and 1st term is separate

Write a recursive formula for the following sequences.

1) 100, 96, 92, ...

$a_n = a_{n-1} - 4$; $a_1 = 100$

2) 200, 40, 8, ...

$a_n = \frac{a_{n-1}}{5}$; $a_1 = 200$

Find the first 3 terms in each sequence below.

3) $a_n = a_{n-1} - 0.25$ *and* $a_1 = 3.5$

$a_1 = 3.5$

$a_2 = a_1 - .25 = 3.5 - .25 = 3.25$

$a_3 = a_2 - .25 = 3.25 - .25 = 3$

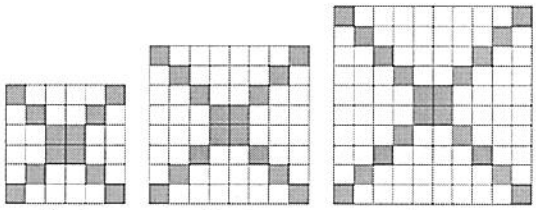
4) $a_n = a_{n-1} \bullet 4$ *and* $a_1 = \frac{1}{8}$

$a_1 = \frac{1}{8}$

$a_2 = a_1 \cdot 4 = \frac{1}{8} \cdot 4 = \frac{1}{2}$

$a_3 = a_2 \cdot 4 = \frac{1}{2} \cdot 4 = 2$

5) The figure below represents the first three terms of a sequence.



12 16 20

(shaded boxes)

pattern : +4

first term : 12

explicit: $a_n = 12 + 4(n-1)$

Which of the following rules can be used to define the sequence? Select all that apply. Justify your response.

A. $a_n = a_{n-1} + 4$; $a_1 = 12$ — pattern +4; 1st term

B. $a_n = 4n + 8$ — simplified version of $a_n = 12 + 4(n-1) = 12 + 4n - 4$

C. $a_{n+1} = a_n + 4$; $a_1 = 12$ — previous term (one less than n)

D. $a_n = 12 + 4(n-1)$ — explicit rule

E. $a_n = a_{n-1} + 12$; $a_1 = 4$ — not pattern; not first term

F. $a_n = 4 + 12(n-1)$ — not first term; not pattern

The TAKEAWAY

Sequences defined **recursively** use the previous term(s) to find the next term of the sequence.

(first term and pattern)

Sequences defined **explicitly** use the explicit formula to find the *n*th term.